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THE MINERAL PROPERTIES AND PROBABLE PROVENANCE OF A 33,000 YEAR OLD OPALINE ARTIFACT FROM DEVIL'S LAIR, SOUTH-WESTERN AUSTRALIA

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ABSTRACT

An opaline artifact, 33,000 years old, with the curious property of periodically changing colour, has been recovered from Devil's Lair, in south-western Western Australia. Its provenance is uncertain, but it is likely to have come from an amygdale in the Bunbury Basalt.

INTRODUCTION

In March 1976 a small conchoidally fractured mineral fragment, identified by Dortch as a flaked artifact, and having the remarkable property of periodically changing colour, was recovered by Western Australian Museum excavators from a part of the cave deposit at Devil's Lair radiocarbon dated at 33,000 years B.P. (for discussion of age and typology see Dortch 1979). The specimen, number B5258 in the Archaeological Collection of the Western Australian Museum, comes from a mixture of layers 33 and 34 in Trench 8_7, depth *circa* 400 cm below cave datum. The following note describes its mineralogy and probable provenance.

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MINERALOGY

The specimen measured 4.72 x 3.81 x 2.56 mm before fragmentation (**P. 1; Fig. 1**), and changed from time to time in the laboratory from clear, transparent, greyish yellow (5YR8/4) and translucent, moderate yellowish-brown (10YR5/4) to opaque white (N9) (colours from Rock-color Chart Committee, 1963). When clear, examination with the binocular microscope revealed small areas showing a play of colour. The mineral has no cleavage, but is cut by irregular cracks, and in fact split along the larger cracks when immersed in a mixture of water and Clericis Solution to determine its specific gravity. The apparent initial specific gravity of the specimen was 1.84, but with increasing fragmentation and the elimination of some cracks, the apparent specific gravity of individual grains rose, and approached 2.0.

In oils, under the polarizing microscope, the mineral is colourless to very pale greyish yellow. It is isotropic with a refractive index of 1.453 ± 0.002, and is therefore opal. Some cracks are lined with feathery to dendritic coatings of greyish orange (10YR7/4), to moderate brown (5YR4/4) and greyish black (N2) cloudy mineral which is white in reflected light. Other cracks change from white through various colours of the spectrum when the stage is rotated. This phenomenon is probably caused by a film of air, and is responsible for the play of colour mentioned earlier.

The mineral was shown to be non-crystalline by an X-ray powder photograph, verifying the optical determination of opal. The remarkable colour changes noted in the hand specimen are probably caused by absorption of varying amounts of water from the atmosphere as the humidity changes.

PROBABLE ORIGIN AND PROVENANCE

Opal is known in two rock types from south-western Australia, namely chert of the Late Eocene Plantagenet Group, and siliceous amygdales of the Early Cretaceous Bunbury Basalt. Neither source can be ruled out at present, but the possibility of derivation from the basalt is the stronger.

The Bunbury Basalt crops out sporadically between the Darling Fault on the east, and the Leeuwin Block on the west (see **Fig. 2**). Basalt is also predicted from aeromagnetic data to be present off-shore north-west of Bunbury, and along parts of the southern coast between Augusta and the Darling Fault. By contrast, no Plantagenet Group rocks are known west of the Darling Fault, and they form a patchy veneer on the Precambrian basement to the east.

Opal has been observed, together with chalcedony, quartz, calcite and zeolites in amygdales in Bunbury Basalt dredged from the floor of Bunbury harbour in 1974. Some amygdales are up to 20cm long, and are used as ornaments. Large siliceous

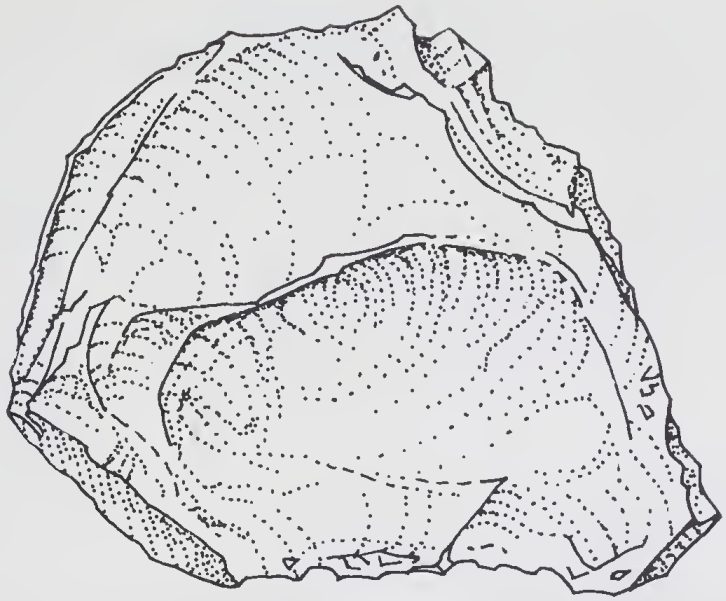

Fig. 1. Line drawing of the opaline artifact from Devil's Lair, layers 33-34, Trench 8_7 (cf. Dortch 1979, **Figs 2-5**).

Pl. 1. Photograph of the opaline artifact from Devil's Lair. The specimen measures 4.72 x 3.81 x 2.56 mm.

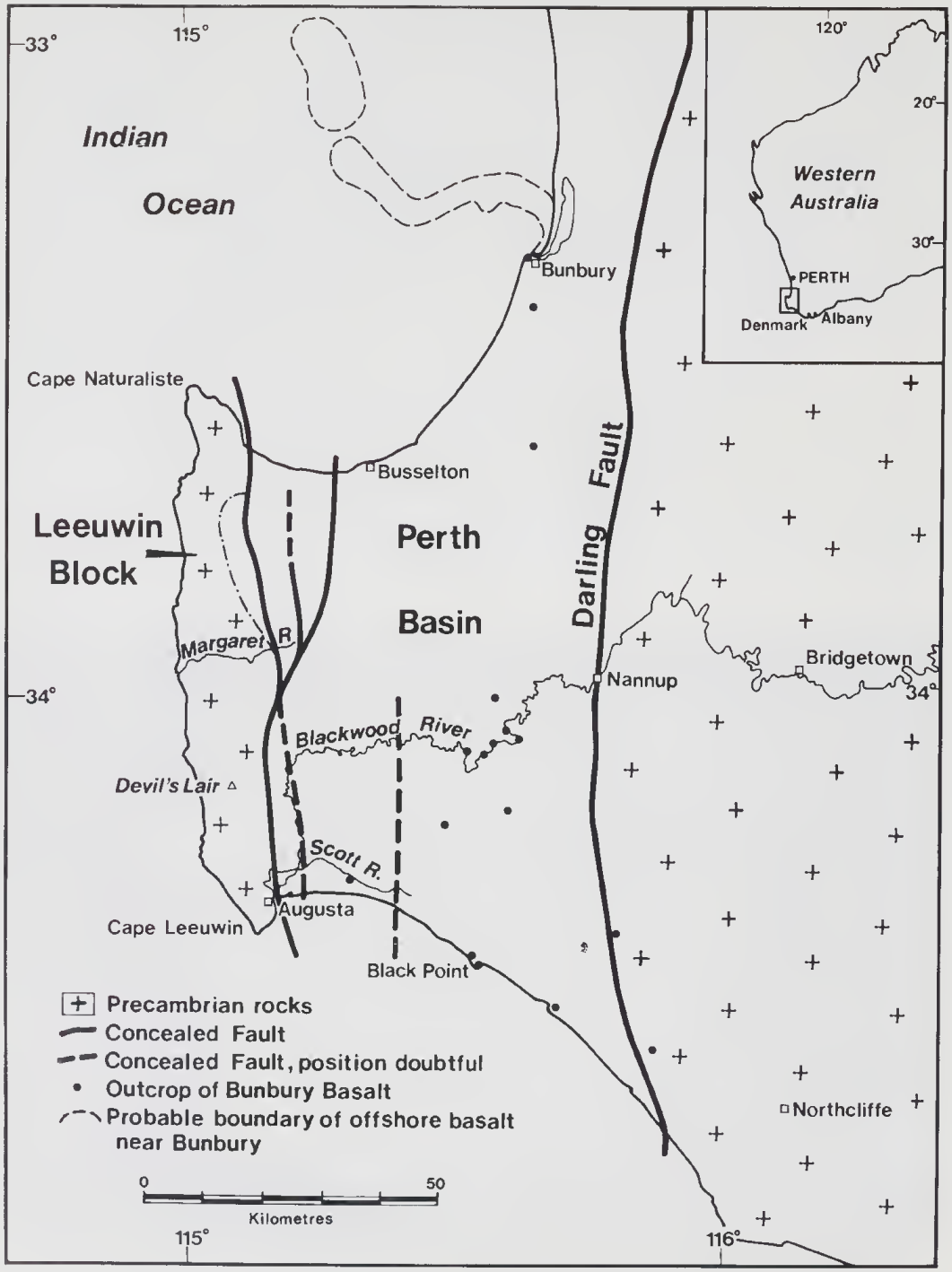

Fig. 2. Map of south-western Australia. Geology based on Lowry (1965).

amygdales containing some opal have been found near the top of the basalt in Gelorup Quarry, about 8km south of Bunbury. Siliceous amygdales are known from the Black Point area, but superficial work on their mineralogy has revealed no opal. It is of interest that broken, ovoid, siliceous bodies with radial and concentric textures, found on the surface roughly 1 km east of Black Point, may be amygdales that have been worked by Aborigines. Some fragments are about 10 cm long.

Colloform opal has been described in Plantagenet Group chert artifacts from Albany and Denmark (Glover 1975), and opal has also been observed in artifacts from the Northcliffe area (Dortch & Gardner 1976). It seems generally to form rather finely intergrown masses with chalcedony, and no flakes of pure opal appear so far to have been observed. Palimpsests of microfossils are present in some of the opal.

Opal is absent from chert artifacts described from surface scatters on the Perth Basin and Leeuwin Block. Most of these artifacts consist essentially of fossiliferous cryptocrystalline silica with a little chalcedony. It has been proposed that these artifacts came from an offshore source to the west (Glover 1975). A little opaline silica has been observed in the chambers of some microfossils in chert flakes recovered from Devil's Lair, but these flakes consist mainly of cryptocrystalline and microcrystalline silica and resemble the surface material from the Perth Basin and Leeuwin Block (Glover 1974). They differ texturally from flakes from Albany, Denmark and Northcliffe.

There are several considerations, none conclusive in itself, which suggest that the opal artifact in Devil's Lair originated in the Bunbury Basalt. The absence of microfossil remnants accords with an amygdaloidal origin. The size of the body makes it more likely to have come from a large amygdale than from the finely intergrown masses of opal and chalcedony in chert of the kind used for artifacts around Albany, Denmark and Northcliffe. The chert artifacts higher in the sequence at Devil's Lair show no petrographic evidence of derivation from the distant Plantagenet rocks. Finally, there is a band of basalt outcrops, some of which contain opaline amygdales, between Devil's Lair and the Plantagenet Group rocks to the east.

CONCLUSIONS

The unusual mineral artifact from Trench 8_7 in Devil's Lair is opal. Its changes in colour are probably caused by absorption of moisture from the atmosphere. Its most likely provenance is amygdaloidal rock in the Bunbury Basalt, but it is not possible at present to be more precise about its origin. The presence of this stone, which is unequivocally an artifact, in the cave deposit indicates contacts or movements in the range 25-100 km by people living at Devil's Lair 33,000 years ago **(Fig. 2)**.

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